

Effectiveness of Smart City Policy Implementation in Improving the Quality of Public Services: Case Study in Denpasar City

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Abstract

This study aims to evaluate the effectiveness of the implementation of smart city policies in improving public service quality in Denpasar. As a city that has adopted digital technology to enhance efficiency and sustainability, Denpasar focuses on utilizing the Internet of Things (IoT), digital twins, and digital platforms to improve public services. This research uses a descriptive qualitative approach with in-depth interviews and literature review to explore the perspectives of various stakeholders, both from the government and the community. The results show that although the smart city policy has had a positive impact on service efficiency in several sectors such as transportation and waste management, its implementation is still hindered by infrastructure issues, digital literacy among the public, and inter-sectoral coordination. Some of the main challenges faced include limited internet access and concerns over data security. This study recommends that the Denpasar government improve technology infrastructure, strengthen public digital literacy, and enhance cross-sector collaboration to maximize the potential of smart cities in improving public service quality.

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1. INTRODUCTION

Rapid technological developments have driven urban transformation toward the smart city concept, where technology is used to improve efficiency, sustainability, and the quality of life for residents. Denpasar, one of the cities in Indonesia, has adopted a smart city policy to improve the quality of public services, with a focus on integrated data management, the use of the Internet of Things (IoT), and the use of digital technology to meet the needs of urban communities. The implementation of this policy covers various sectors, such as transportation, energy, and healthcare, aiming to create a more responsive and sustainable city. (Ghazal, 2021; Hoang, 2021).

However, the effectiveness of this policy remains a major challenge. Despite the enormous potential of leveraging technologies like digital twins (Deng et al., 2021) and blockchain for authentication and authorization (Esposito, 2021), implementation in the field is often hampered by technical issues, limited infrastructure, and low digital literacy among the public. Therefore, this research is important to evaluate the effectiveness of smart city policies in Denpasar City in improving the quality of public services and to identify supporting and inhibiting factors.

In the literature, there is debate about the extent to which smart cities can address the challenges of urbanization and improve the quality of public services. On the one hand, Zhao (2021) and Saleem (2022) show that the adoption of IoT and 5G technology can

improve the efficiency of public services through real-time data processing and better resource management. However, on the other hand, Syed (2021) and Y. Liu (2021) emphasized that the success of a smart city is highly dependent on the readiness of infrastructure, regulations, and data security.

In addition, the concept of digital twins, as discussed by Li (2022) and White (2021), offers great potential in supporting data-driven decision-making, but its implementation requires significant investment and complex cross-sector integration. This shows that while the technologies supporting smart cities continue to evolve, operational and strategic challenges remain major obstacles to achieving sustainability and efficiency goals. (Allam, 2022; Gheisari, 2021).

Currently, many areas in Denpasar City still lack adequate internet access, limiting the effectiveness of IoT technology and digital systems. Most people don't fully understand how to utilize technology in their daily lives, hampering the adoption of smart city policies. (Ghazal, 2021; Herath, 2022) Concerns about personal data security and potential privacy breaches are among the main obstacles to implementing digital technology for public services. (Ismagilova, 2019; Kim, 2021). Cross-sector integration, such as transportation, energy, and health, is often hampered by a lack of effective communication and coordination among stakeholders. (Bellini, 2022; Ramu, 2022). Initial investment in developing technological infrastructure and human resource training requires huge costs, which are difficult to cover by local government budgets. (Javed, 2022; Kashef, 2021).

Taking these issues into account, this study aims to evaluate the effectiveness of smart city policy implementation in Denpasar and provide recommendations for improving the quality of public services. This research will also enrich academic discussions on the challenges and opportunities in implementing smart cities in developing countries like Indonesia.

2. LITERATURE REVIEW

A smart city is generally defined as an urban area that integrates digital technology into its infrastructure and services to improve the quality of life for its citizens. The smart city framework is built on various dimensions such as governance, economy, mobility, environment, livelihoods, and energy. (Hoang, 2021) Smart city development is closely linked to the goal of sustainable urban growth, with the goal of increasing resource efficiency, improving services, and reducing carbon emissions. Indicators of smart city success often include digital connectivity, energy efficiency, public safety, and citizen participation. (Zhao, 2021) This multidimensional approach is crucial to ensure that technology serves the benefit of urban communities.

The relationship between smart city initiatives and public service delivery is a crucial component of urban governance. In this context, smart technologies such as the Internet of Things (IoT), Artificial Intelligence (AI), and blockchain are increasingly being used to optimize public services, from healthcare to transportation. (Ghazal, 2021) By integrating real-time data, cities can provide more responsive and personalized services, leading to increased efficiency and accessibility. For example, smart health apps help monitor and improve health outcomes by leveraging AI and IoT for diagnostics and patient management. (Syed, 2021).

The quality of public services in smart cities is evaluated through various indicators such as accessibility, responsiveness, transparency, and user satisfaction. (Esposito, 2021) These indicators are crucial for assessing how effectively smart technologies meet the needs of urban populations. Technologies such as machine learning contribute significantly by enabling more effective traffic management, waste management, and energy

conservation systems, thus directly impacting the quality of public services provided. (Mylonas, 2021).

The application of advanced technology in public service delivery not only improves operational efficiency but also helps address various urban challenges such as traffic congestion, pollution, and resource waste. Smart systems, particularly those based on big data and cloud computing, enable cities to predict and proactively address problems. For example, digital twin technology is being used to simulate real-world conditions and improve urban planning, public health management, and emergency response. (Deng et al., 2021) This technological evolution is crucial in adapting cities to the needs of modern urbanization while maintaining sustainable development.

Indonesia has adopted a national policy to support smart city development, particularly focusing on improving connectivity and integrating technology into urban infrastructure. The Indonesian government's "100 Smart Cities" program aims to create more efficient urban environments by leveraging digital tools to improve governance, public services, and infrastructure management. (Javed, 2022) This policy emphasizes collaboration between government agencies, the private sector, and the community to realize the full potential of smart city technology in the country.

Denpasar, Bali, is becoming a model for implementing smart city policies in Indonesia. This smart city initiative focuses on optimizing urban services such as waste management, water supply, and transportation systems through IoT applications and digital government platforms. (Ismagilova, 2022) By leveraging technology to improve efficiency in public administration, Denpasar has successfully enhanced citizen engagement and the quality of public services. This city's approach demonstrates the integration of a smart city framework with the local context, addressing environmental sustainability and social inclusivity.

Public policy theory serves as a foundation for understanding how smart city initiatives are structured and evaluated. Public policy in the context of smart cities is often guided by frameworks that promote transparency, accountability, and sustainability. The CIPP (Context, Input, Process, Product) model is often used to evaluate the effectiveness of smart city projects, allowing a comprehensive review of objectives, implementation strategies, and outcomes. (Bellini, 2022). A framework like this is essential to guide the successful integration of technology into urban governance.

Evaluation models such as the Balanced Scorecard have been widely applied to assess smart city performance, focusing on both financial and non-financial indicators. This model allows city planners to measure the success of various smart city initiatives in terms of their impact on economic growth, environmental sustainability, and social well-being. For example, smart city applications in energy management and waste reduction can be evaluated using sustainability metrics, which also align with broader global goals such as the United Nations' Sustainable Development Goals (SDGs). (Al-Turjman, 2022).

Several studies have examined the integration of smart city technologies into public services and their impact on urban governance. Research shows that IoT-based solutions are increasingly being used to monitor and optimize energy consumption, traffic flow, and public safety in smart cities. (Ullah, 2021). In addition, the study highlights the importance of securing data privacy and integrity in smart cities, as these systems collect large amounts of personal and public data. (Chen, 2021) The findings of this study emphasize the need for a balanced approach that addresses both the opportunities and challenges of smart city implementation.

Despite the extensive research on smart cities, significant gaps remain, particularly in understanding the long-term social and economic impacts of these technologies on urban

populations. Future research should focus on the interplay between technology, policy, and citizen participation to ensure that smart city initiatives are inclusive and equitable. (Branch, 2022). In addition, studies that examine the role of new technologies such as 5G and AI in shaping future smart cities will be crucial to addressing the evolving needs of urban communities. (Zekić-Sušac, 2021).

3. METHOD

This study uses a descriptive qualitative approach to explore and describe in depth the effectiveness of smart city policy implementation in improving the quality of public services in Denpasar City. The qualitative approach provides a more holistic understanding of the experiences and perspectives of various stakeholders, both government and public, regarding the smart city policy. (Arikunto, 2017) In this study, data will be obtained through in-depth interviews with local government officials, smart city program managers, and users of technology-based public services. (Tashakkori, A., & Teddlie, 2010).

In addition to interviews, this study also utilizes a literature review as part of its research method. Relevant literature will be collected to identify the theories underlying smart city policies and to explore experiences and findings from previous research on smart city implementation in other cities. This literature provides an overview of smart city policies, their dimensions, and the indicators used to assess the quality of public services. Researchers will also analyze articles discussing the challenges, opportunities, and impacts of technology implementation in public services.

The data collection process was conducted by selecting informants with a deep understanding of smart city policies, including local government officials, parties involved in smart city infrastructure development, and residents who experience its impacts. Semi-structured interviews were used to allow for open and in-depth discussions while maintaining a focus on relevant topics. (Bellini, 2022) All collected data were then analyzed using thematic analysis techniques to identify key patterns related to the effectiveness of smart city policies in improving the quality of public services.

In this study, the results of the thematic analysis are combined with the results of the literature review to provide a more comprehensive understanding of the factors influencing the success of smart city policies in Denpasar City. The findings of this study are expected to contribute to formulating policy recommendations to improve smart city implementation in Indonesia, as well as assist local governments in designing more effective policies to improve the quality of technology-based public services. (Ismagilova, 2022).

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4. RESEARCH RESULTS AND DISCUSSION

Description of Smart City Policy in Denpasar

From interviews and observations, it is understood that the Smart City policy in Denpasar is part of the local government's efforts to create a more efficient, modern, and sustainable city by leveraging digital technology across various sectors. One of the main focuses of this policy is the implementation of the Internet of Things (IoT) to optimize public services, such as transportation systems, waste management, and water supply regulation. By integrating technology into the city's infrastructure, Denpasar strives to improve the quality of life for its residents and accelerate sustainable development.

One of the key components of Denpasar's smart city policy is the use of digital platforms for public services, such as mobile apps for accessing administrative, health, and transportation services. For example, a waste monitoring app connected to IoT sensors allows waste managers to monitor bin occupancy levels in real time, making the collection

process more efficient. This system aims to reduce waiting times, increase responsiveness, and lower operational costs.

Furthermore, the Denpasar City government is also focusing on developing digital infrastructure, including strengthening internet networks and data centers that can support cloud-based services. This is crucial for seamlessly connecting various public services and providing fast and accurate information to the public. The use of big data and intelligent analytics is also beginning to be integrated to facilitate more efficient planning and management of resources, such as in the energy and transportation sectors.

The implementation of the smart city policy in Denpasar involves not only the government but also collaboration with the private sector and the community. The development of this smart city aims to create an inclusive and participatory ecosystem, where citizens can contribute to decision-making through existing digital platforms. While this policy offers various benefits, challenges in terms of infrastructure readiness, the digital divide, and data security remain obstacles that need to be addressed to optimally realize the smart city vision in Denpasar.

Implementation Effectiveness

The effectiveness of the Smart City policy implementation in Denpasar can be measured through various public service quality indicators, including responsiveness, transparency, efficiency, and public satisfaction. Responsiveness is reflected in the smart city system's ability to respond quickly and accurately to public needs, such as in managing complaints or service requests. Technology-based applications that enable the public to report problems or obtain information more easily are one factor that increases the responsiveness of public services in Denpasar.

Transparency is also a crucial aspect measured in evaluating the effectiveness of this policy. With a system based on open data and digital applications, citizens can easily access information about public services, such as waste management status, infrastructure maintenance, or budget allocation. This helps establish government accountability and increases public trust in city management. The existence of digital platforms that allow citizens to provide direct feedback also contributes to transparency.

Operational efficiency is another indicator that measures the extent to which technology can reduce costs and time in providing public services. In Denpasar City, the application of IoT in traffic management, water supply regulation, and waste management has shown significant results in terms of time and resource efficiency. For example, a technology-based traffic management system can reduce congestion and improve citizen mobility. Similarly, the use of sensors for waste monitoring allows for more timely waste collection, thereby reducing waste and increasing operational efficiency.

However, despite some successes, challenges related to the implementation of appropriate technology and the level of public adoption of digital services remain obstacles. Some areas in Denpasar lack adequate internet infrastructure, while public digital literacy remains limited. Therefore, while smart city policies have had a positive impact on improving the quality of public services, their effectiveness is still influenced by infrastructure readiness and the level of public participation.

Supporting and Inhibiting Factors

Supporting and inhibiting factors in the implementation of the Smart City policy in Denpasar City play a crucial role in determining its effectiveness. Key supporting factors include technological infrastructure readiness, government commitment, and community support. Denpasar City has adopted various advanced technologies such as the Internet of Things (IoT) and digital twins, enabling more effective and efficient data management.

Furthermore, the government's commitment to encouraging technological innovation and collaboration with various stakeholders, including the private sector and communities, strengthens Smart City implementation.

On the other hand, inhibiting factors cannot be ignored. One major challenge is limited technological infrastructure in some areas, which hinders accessibility to technology-based services. Furthermore, low levels of digital literacy among the public are also a barrier, reducing active participation in the use of smart city technology. Insufficient data security is also a critical issue that needs to be addressed to increase public trust in digital services.

Another challenge is limited cross-sectoral coordination, which hinders the integration of various smart city services such as transportation, energy, and healthcare. The lack of direct involvement from the private sector and the civil society sector also hinders aligning policies with the real needs of the community. Therefore, while smart cities have significant potential, successful implementation still depends on strengthening these aspects.

Discussion of Findings

The discussion of the research findings will link the analysis to previous theories and research and explore the implications of the findings for broader public policy. Based on the research findings, the Smart City policy in Denpasar City has shown some progress, although there are challenges that must be overcome. Key findings indicate that technologies such as the Internet of Things (IoT) and digital twins have made significant contributions to improving the efficiency of public services, particularly in waste management, traffic management, and energy distribution. This aligns with the theory of applying technology to improve efficiency and quality of life in urban areas.

However, despite the application of advanced technology, the effectiveness of smart city policy implementation is still limited by uneven infrastructure, particularly in more remote areas. This factor aligns with previous research that emphasizes the importance of infrastructure readiness to support smart city success (L. Liu, 2021; Syed, 2021). The use of integrated technology and the utilization of real-time data can improve service responsiveness, but if the underlying infrastructure is inadequate, this potential will not be maximized optimally.

In terms of public participation, despite efforts to improve digital literacy, many residents still find it difficult to access and use smart city-based applications. This indicates the need for further training and outreach regarding the use of digital technology in everyday life. This finding aligns with research demonstrating the importance of improving digital literacy to enable greater public involvement in the smart city development process. (Ghazal, 2021).

From a public policy perspective, these findings provide insight into the importance of collaboration between the public, private, and community sectors in achieving successful smart city implementation. Synergy between these various parties needs to be strengthened, both in terms of infrastructure provision and in managing inclusive and sustainable policies. This discussion highlights that to create smart and sustainable cities, the government needs to continuously evaluate and adjust existing policies to overcome existing obstacles and capitalize on the opportunities offered by technology.

5. CONCLUSION

Based on the research results, it can be concluded that the implementation of smart city policies in Denpasar has had a positive impact on the efficiency and quality of public services, particularly in sectors such as waste management, transportation, and energy

distribution. However, the effectiveness of this policy still faces challenges related to infrastructure, public digital literacy, and inter-sectoral coordination, which require improvement.

The application of technologies such as IoT and digital twins shows significant potential for improving the responsiveness and transparency of public services. However, to maximize this potential, it is crucial for the government to continuously strengthen technological infrastructure and increase public accessibility and understanding of existing technologies. Further training and outreach on the use of smart city-based applications will significantly increase active public participation.

Furthermore, this study recommends that the Denpasar City government continue to evaluate its implemented smart city policies and consider the supporting and inhibiting factors identified in this study. Closer collaboration between the government, private sector, and community is essential to address existing challenges and capitalize on opportunities for sustainable smart city development. These recommendations are expected to contribute positively to the development of more effective, efficient, and inclusive smart city policies in the future.

In conclusion, although the implementation of smart city policies in Denpasar still faces several obstacles, this study demonstrates that smart cities have significant potential to improve the quality of public services, creating a more responsive, efficient, and sustainable city. With continued commitment and efforts, it is hoped that Denpasar can serve as an example for other cities in implementing smart city policies to improve the quality of life for its citizens.

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